

Claims:

The claims have been amended as follows:

1. (currently amended) A machine used in computing one of more sums of products, wherein at least one of said sums of products includes the product of a first input and a first weight and the product of a second input and a second weight, where said first input differs from said second input and where said first weight differs from said second weight, is not a desired product of two numbers, comprising:
 - a. a first number represented in a first finite-precision numeric format, ~~said first number being a member of a first multiplier-defined restricted set and~~ having a first numeric value;
 - b. a second number represented in a second finite-precision numeric format and having a second numeric value;
 - c. first multiplier means ~~for computing a first product equal to the product of said first number and said second number, where~~ comprising a first multiplier input, a first multiplicand input, a first product output, and a first multiplicity of control signals, where:
 - i. there is at least one state of said first multiplicity of control signals such that with said first number as said first multiplier input, with said second number as said first multiplicand input, and with said first number a member of a first multiplier-defined restricted set, said first product output has a numeric value equal to the product of said first numeric value and said second numeric value; and said first multiplier means can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is any number from said first multiplier-defined restricted set and the second multiplier input is said second number
 - ii. there is no state of said first multiplicity of control signals such that with said first number as said first multiplier input, with said

second number as said first multiplicand input, with said first number not a member of said first multiplier-defined restricted set, with said first numeric value not equal to zero, and with said second numeric value not equal to zero, said first product output has a numeric value substantially equal to said product of said first numeric value and said second numeric value; said first multiplier
~~means cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said first multiplier-defined restricted set, the second multiplier input is said second number, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero~~

- iii. ~~said first multiplier-defined restricted set has more than one member;~~
- iv. ~~said first multiplier-defined restricted set does not include all the members of a first unrestricted set, said first unrestricted set including consisting of all numbers having said first finite-precision numeric format; and~~ and not including numbers in other finite-precision numeric formats

v. where either

- 1. said first multiplier input is said first input and said first multiplicand input is said first weight, or
- 2. said first multiplier input is said first weight and said first multiplicand input is said first input;

whereby said first multiplier means is not a general multiplier ~~product may be computed with reduced complexity compared to computation of said first product using general multiplier means, said general multiplier means being able to compute the product of said second number and any member of said first unrestricted set~~ when said second numeric value is not equal to zero.

2. (currently amended) The machine of claim 1 in which said first multiplier-defined restricted set includes a first member number having a numeric value equal to zero.
3. (currently amended) The machine of claim 1 in which said first multiplier-defined restricted set includes a first member having numeric value that is not equal to zero, not equal to positive one, and not equal to or negative one, and a second member having numeric value that is not equal to zero, not equal to positive one, and not equal to or negative one.
4. (currently amended) The machine of claim 1 in which said first multiplier-defined restricted set has exactly two members, which are a first member and a second member.
5. (currently amended) The machine of claim 4 in which said first member one member of said first multiplier-defined restricted set has a is a number having a numeric value equal to zero.
6. (currently amended) The machine of claim 4 in which the numeric value of said first member each member of said first multiplier-defined restricted set is equal to the negative of the numeric value of is the negative of the other said second member.
7. (currently amended) The machine of claim 4 in which each said first member of said first multiplier-defined restricted set is a shifted version of can be obtained by shifting the representation element values of said second the other member.
8. (original) The machine of claim 1 in which said first multiplier-defined restricted set has more than two members.

9. (currently amended) The machine of claim 1 wherein said first multiplier-defined restricted set has a first member and a second member with the following properties:
- a. said first member is not an integer multiple of said second member; and
 - b. said second member is not an integer multiple of said first member.
- ~~whereby said first multiplier-defined restricted set has at least two members that are related by at least one shift and one addition.~~
10. (currently amended) The machine of claim 1, further including:
- a. a third number represented in a third finite-precision numeric format and having a third numeric value; ~~said third number being a member of a second multiplier-defined restricted set~~
 - b. a fourth number represented in a fourth finite-precision numeric format and having a fourth numeric value; and
 - c. second multiplier means comprising a second multiplier input, a second multiplicand input, for computing a second product output, and a second multiplicity of control signals, equal to the product of said third number and said fourth number, where
 - i. there is at least one state of said second multiplicity of control signals such that with said third number as said second multiplier input, with said fourth number as said second multiplicand input, and with said third number a member of a second multiplier-defined restricted set, said second product output has a numeric value equal to the product of said third numeric value and said fourth numeric value; ~~said second multiplier means can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is any number from said second multiplier-defined restricted set and the second multiplier input is said fourth number~~
 - ii. there is no state of said second multiplicity of control signals such that with said third number as said second multiplier input, with

said fourth number as said first multiplicand input, with said third number not a member of said second multiplier-defined restricted set, with said third numeric value not equal to zero, and with said fourth numeric value not equal to zero, said second product output has a numeric value substantially equal to said product of said third numeric value and said fourth numeric value; and said second multiplier means cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said second multiplier-defined restricted set, the second multiplier input is said fourth number, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero

- iii. said second multiplier-defined restricted set has more than one member.

~~whereby said first product and said second product may be computed with lower complexity than if general multiplier means were used to compute each product.~~

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- 11. (currently amended) The machine of claim 10 wherein said second multiplier-defined restricted set does not include all members of a second unrestricted set consisting of, ~~said second unrestricted set including all numbers having said third finite-precision numeric format and not including numbers in other finite-precision numeric formats, whereby each of said first multiplier means and said second multiplier means is neither constant multiplier means nor general multiplier means.~~
 - 12. (original) The machine of claim 10 wherein said first multiplier-defined restricted set and said second multiplier-defined restricted set do not have any common members.
 - 13. (currently amended) The machine of claim 1, in which:

~~a. said second number is a member of a second multiplier-defined restricted set~~

b.a. for said first multiplier means

- i. there is at least one state of said first multiplicity of controls signals such that with said first number as said first multiplier input, with said second number as said first multiplicand input, with said first number a member of said first restricted set, and with said second number a member of a second restricted set, said first product output has a numeric value equal to the product of said first numeric value and said second numeric value; can compute the product of a first multiplier input and a second multiplier input when the first multiplier input is a member of said first multiplier-defined restricted set and the second multiplier input is a member of said second multiplier-defined restricted set
- ii. there is no state of said first multiplicity of control signals such that with said first number as said first multiplier input, with said second number as said first multiplicand input, with said first number not a member of said first multiplier-defined restricted set, with said second number a member of said second multiplier-defined restricted set, with said first multiplier input not having a numeric value of zero, and with said second multiplier input not having a numeric value of zero, said first product output has a numeric value substantially equal to said product of said first numeric value and said second numeric value; and cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is not a member of said first multiplier-defined restricted set, the second multiplier input is a member of said second multiplier-defined restricted set, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero
- iii. there is no state of said first multiplicity of control signals such that with said first number as said first multiplier input, with said

second number as said first multiplicand input, with said first number a member of said first multiplier-defined restricted set, with said second number not a member of said second multiplier-defined restricted set, with said first multiplier input not having a numeric value of zero, and with said second multiplier input not having a numeric value of zero, said first product output has a numeric value substantially equal to said product of said first numeric value and said second numeric value cannot compute the product of a first multiplier input and a second multiplier input when the first multiplier input is a member of said first multiplier-defined restricted set, the second multiplier input is not a member of said second multiplier-defined restricted set, the first multiplier input has numeric value not equal to zero, and the second multiplier input has numeric value not equal to zero

e.b. said second multiplier-defined restricted set does not include all the members of a second unrestricted set, said second unrestricted set including consisting of all numbers having said second finite-precision numeric format, and not including numbers in other finite-precision numeric formats

whereby said first multiplier means can have lower complexity than if it must be able to compute the product of said first number and any number in said second unrestricted set.

14. (original) The machine of claim 13 in which said second multiplier-defined restricted set has exactly one member.
15. (original) The machine of claim 14 in which the one member of said second multiplier-defined restricted set has numeric value not equal to zero, positive one, or negative one.

16. (original) The machine of claim 13 in which said second multiplier-defined restricted set has more than one member.
17. (currently amended) A method used in computing one or more sums of products, wherein at least one of said sums of products includes the product of a first input and a first weight and the product of a second input and a second weight, where said first input differs from said second input and where said first weight differs from said second weight, is not a desired product of two ~~numbers,~~ comprising first multiplication of a first number by a second number to produce a first product ~~equal to the product of said first number and said second number,~~ where:
- a. said first number is represented in a first finite-precision numeric format;
~~said first number being a member of a first multiplication-defined restricted set~~
 - b. said second number is represented in a second finite-precision numeric format;
 - c. said first ~~multiplication can compute the product of a first multiplication input and a second multiplication input~~ is substantially equal to the product of said first number and said second number when said the first multiplication input number is any number from a member of a said first multiplication-defined restricted set; and the second multiplication input is said second number
 - d. said first ~~multiplication cannot compute product~~ is not equal to said product of said first number and said second number ~~the product of a first multiplication input and a second multiplication input when said the first multiplication input number is not a member of said first multiplication-defined restricted set, the second multiplication input is said second number, the said first number multiplication input has a numeric value not equal to zero, and said the second multiplication input number has a~~ numeric value not equal to zero;
 - e. said first multiplication-defined restricted set has more than one member;

~~f. said first multiplication-defined restricted set does not include all the members of a first unrestricted set, said first unrestricted set including consisting of all numbers having said first finite-precision numeric format; and ~~and not including numbers in other numeric formats~~~~

f. where either

1. said first multiplier input is said first input and said first multiplicand input is said first weight, or
2. said first multiplier input is said first weight and said first multiplicand input is said first input;

~~whereby said first product may be computed with reduced complexity compared to computation of said first product is not computed using general multiplication, said general multiplication being able to compute the product of said second number and any member of said first unrestricted set.~~

18. (currently amended) The method of claim 17 in which said first multiplication-defined restricted set includes a member having a numeric value equal to zero~~the number zero~~.
19. (currently amended) The method of claim 17 in which said first multiplication-defined restricted set includes a first member with numeric value not equal to zero, not equal to positive one, and not equal to ~~or negative one,~~ and a second member with numeric value not equal to zero, not equal to positive one, and not equal to ~~or negative one~~.
20. (currently amended) The method of claim 17 in which said first multiplication-defined restricted set has exactly two members, which are a first member and a second member.
21. (currently amended) The method of claim 20 in which ~~one~~ said first member of said first multiplication-defined restricted set has a numeric value equal to ~~is the number~~ zero.

22. (currently amended) The method of claim 20 in which the numeric value of said first ~~each~~ member of said first multiplication-defined restricted set is equal to the negative of the numeric value of said second ~~is the negative of the other member.~~
23. (currently amended) The method of claim 20 in which ~~each~~ said first member of said first multiplication-defined restricted set is a shifted version of set ~~can be obtained by shifting the representation element values of the other said second member.~~
24. (original) The method of claim 17 in which said first multiplication-defined restricted set has more than two members.
25. (currently amended) The method of claim 17 wherein said first multiplication-defined restricted set has a first member and a second member with the following properties:
- a. said first member is not a integer multiple of said second member; and
 - b. said second member is not an integer multiple of said first member,
- ~~whereby said first multiplication-defined restricted set has at least two members that are related by at least one shift and one addition.~~
26. (currently amended) The method of claim 17, further including second multiplication of a third number by a fourth number to produce a second product ~~equal to the product of said third number and said fourth number,~~ where:
- a. said third number is represented in a third finite-precision numeric format and having a third numeric value; ~~said third number being a member of a second multiplication-defined restricted set~~
 - b. said fourth number is represented in a fourth finite-precision numeric format and having a fourth numeric value;

- c. said second product is not equal to the product of said third number and said fourth number ~~second multiplication method can compute the product of a first multiplication input and a second multiplication input when the said third number first multiplication input is any number from said second multiplication-defined restricted set and the second multiplication input is said fourth number;~~
- d. said second product is not equal to the product of said third number and said fourth number ~~multiplication method cannot compute the product of a first multiplication input and a second multiplication input when the said first multiplication input number is not a member of said second multiplication-defined restricted set, the second multiplication input is said fourth number, the said third first multiplication input number has numeric value not equal to zero, and said fourth the second multiplication input number has numeric value not equal to zero; and~~
- e. said second multiplication-defined restricted set has more than one member.

~~whereby said first product and said second product may be computed with lower complexity than if general multiplication methods were used to compute each product.~~

- 27. (currently amended) The method of claim 26 wherein said second multiplication-defined restricted set does not include all members of a second unrestricted set, ~~said second unrestricted set including~~ consisting of all numbers having said third finite-precision numeric format ~~and not including numbers in other finite-precision numeric formats, whereby each of said first multiplication and said second multiplication is neither constant multiplication nor general multiplication.~~
- 28. (original) The method of claim 26 wherein said first multiplication-defined restricted set and said second multiplication-defined restricted set do not have any common members.

29. (currently amended) The method of claim 17 in which:

~~a. said second number is a member of a second multiplication defined restricted set~~

b. a. for the method of said first multiplication

- i. ~~can compute the~~said first product is substantially equal to the product of said first number and said second number of a first multiplication input and a second multiplication input when the said first multiplication number input is a member of said first multiplication-defined restricted set and when said the second multiplication input number is a member of a said second multiplication-defined restricted set;
- ii. said first product is not equal to said product of said first number and said second number cannot compute the product of a first multiplication input and a second multiplication input when said the first number multiplication input is not a member of said first multiplication-defined restricted set, - said the second multiplication input number is a member of said second multiplication-defined restricted set, said the first multiplication input number has numeric value not equal to zero, and the said second multiplication input number has numeric value not equal to zero; and
- iii. said first product is not equal to said product of said first number and said second number cannot compute the product of a first multiplication input and a second multiplication input when the said first multiplication input number is a member of said first multiplication-defined restricted set, the said second multiplication input number is not a member of said second multiplication-defined restricted set, said the first multiplication input number has numeric value not equal to zero, and said the second multiplication input number has numeric value not equal to zero; and

~~b. c.~~ said second multiplication-defined restricted set does not include all the members of a second unrestricted set, ~~said second unrestricted set including consisting of~~ all numbers having said second finite-precision numeric format, ~~and not including numbers in other finite-precision numeric formats~~
~~whereby the method of said first multiplication can have lower complexity than if it must be able to compute the product of said first number and any number in said second unrestricted set.~~

30. (original) The method of claim 29 in which said second multiplication-defined restricted set has exactly one member.
31. (original) The method of claim 30 in which the one member of said second multiplication-defined restricted set has numeric value not equal to zero, positive one, or negative one.
32. (original) The machine of claim 29 in which said second multiplication-defined restricted set has more than one member.